



Department of Transportation
Federal Aviation Administration
Aircraft Certification Service
Washington, D.C.

TSO-C176

Effective
Date: 07/28/06

Technical Standard Order

Subject: AIRCRAFT COCKPIT IMAGE RECORDER SYSTEMS

- PURPOSE.** This technical standard order (TSO) is for manufacturers and installers of aircraft cockpit image recorder (CIR) systems applying for a TSO authorization or letter of design approval (LODA). In it, we (the Federal Aviation Administration, or FAA) tell you what minimum performance standard (MPS) your CIR systems must first meet for approval and identification with the applicable TSO marking.
- APPLICABILITY.** This TSO affects new applications submitted after its effective date. Major design changes to image recorder systems approved under this TSO will require a new authorization. See Title 14 of the Code of Federal Regulations (14 CFR) § 21.611(b).
- REQUIREMENTS.** New models of CIR systems identified and manufactured on or after the effective date of this TSO must meet the MPS in the European Organization for Civil Aviation Electronics' (EUROCAE) document ED-112, *Minimum Operational Performance Specification for Crash Protected Airborne Recorder Systems*, dated March 2003, or the most current revision. One exception is that compliance with ED-112 chapters 2-5, 3-4, and 5-6 are not required for this TSO. The table below lists recorder types and the ED-112 section or part with the MPS for each:

Recorder MPS Requirements

Recorder Type	ED-112 Reference
Single CIR	Section 2 and Part III
CIR function in deployable recorder	Section 2, Part III, and Section 3
CIR function in combined recorder	Section 2, Part III, and Section 4

a. Functionality. This TSO applies to equipment intended to record aircraft flight images and store the data in crash-protected memory to assist in accident or incident investigations. You can combine this function with other recorder functions such as a flight data recorder and a cockpit voice recorder.

b. Failure Condition Classification. Failure of the function defined in paragraphs 3 and 3.a of this TSO depends on the aircraft installation. Develop the system to, at least, the design assurance level equal to the failure condition classification in the table below:

Classifications of Failure Conditions for Recorders

Recorder type	Failure Classification
Single CIR	Minor
CIR function in deployable recorder	Major
CIR function in combined recorder function:	
• Airplane or rotorcraft with two recorders	Minor
• Rotorcraft with one combined recorder	Major

c. Environmental Qualification. Test the equipment according to RTCA, Inc. document RTCA/DO-160E, *Environmental Conditions and Test Procedures for Airborne Equipment*, dated December 9, 2004, or the most current revision. ED-112 permits using RTCA/DO-160D for environmental testing, but compliance with the MPS of this TSO requires that you use RTCA/DO-160E.

d. Software Qualification. If the article includes a digital computer, develop the software according to RTCA/DO-178B, *Software Considerations in Airborne Systems and Equipment Certification*, dated December 1, 1992, or the most current revision.

e. Deviations. We have provisions for using alternate or equivalent means of compliance to the criteria in the MPS of this TSO. If you invoke these provisions, you must show that the image recorder maintains an equivalent level of safety. Apply for a deviation under 14 CFR § 21.609 before submitting your data package.

4. MARKING.

a. Mark at least one major component permanently and legibly with all the information in 14 CFR § 21.607(d), except:

(1) 14 CFR § 21.607(d)(2). Use the name, type, and part number. Do not use the optional model number.

(2) 14 CFR § 21.607(d)(3). Use the date of manufacture when that information is critical for maintenance or inspections, or both. Do not use the optional serial number.

b. Also, mark the following permanently and legibly with at least the manufacturer's name, subassembly part number, and the TSO number:

(1) Each component that is easily removable (without hand tools),

(2) Each interchangeable element, and

(3) Each sub-assembly of the article that you determined may be interchangeable.

c. If the component includes a digital computer, then the part number must include hardware and software identification. Or, you may use a separate part number for hardware and software. Either way, you must include a means to show the modification status.

NOTE: Similar software versions, approved to different software levels must be differentiated by part number.

d. When applicable, identify the equipment as an incomplete system or that the appliance performs functions beyond those described in paragraphs 3 and 3.a of this TSO.

5. APPLICATION DATA REQUIREMENTS. As a TSO manufacturer-applicant, you must give the FAA aircraft certification office (ACO) manager responsible for your facilities a statement of conformance, as specified in 14 CFR § 21.605(a)(1), and one copy each of the following technical data to support our design and production approval as required by 14 CFR § 21.605(a)(2). (Under 14 CFR § 21.617(a)(2), LODA applicants submit the same data through their civil aviation authority:)

a. Operating instructions and equipment limitations in an installation/instruction manual (IM), sufficient to describe the image recorder's operational capability. Describe all deviations in detail. If needed, identify equipment by part number, version, revision, and criticality level of software, classification for use, and environmental categories.

b. Installation procedures and limitations in an IM, sufficient to ensure that the image recorder's system, when installed in accordance with the installation procedures, still meets this TSO's requirements. The limitations must identify any unique aspects of the installation. Finally, the limitations must include a note with the following statement:

The conditions and tests required for TSO approval of this article are minimum performance standards. Those installing this article, on or in a specific type or class of aircraft, must determine that the aircraft installation conditions are within the TSO standards. TSO articles must have separate approval for installation in an aircraft. The article may be installed only according to 14 CFR part 43 or the applicable airworthiness requirements.

c. Schematic drawings of the installation procedures.

d. Wiring diagrams of the installation procedures.

e. List of components, by part number, that make up the CIR system complying with the standards in this TSO. Include vendor part number cross-references, when applicable.

f. A component maintenance manual (CMM), covering periodic maintenance, calibration and repair, for the continued airworthiness of the installed CIR system. Instructions should

include recommended inspection intervals and service life. Describe the details of deviations granted, as noted in paragraphs **5.a** of this TSO.

g. Material and process specifications list.

h. The quality control system (QCS) description required by 14 CFR §§ 21.143 and 21.605(a)(3), including functional test specifications. The QCS should ensure that you will detect any change to the equipment that could adversely affect compliance with the TSO MPS, and reject the item accordingly. (Not required for LODA applicants.)

i. Manufacturer's TSO qualification test report.

j. Nameplate drawing with the information required by paragraph **4** of this TSO.

k. A list of all drawings and processes (including revision level), to define the article's design. For a minor change, follow the directions in 14 CFR § 21. 611(a). Show any revisions to the drawing list only on our request.

l. An environmental qualifications form as described in RTCA/DO-160E for each component of the system.

m. If the article includes a digital computer: a plan for software aspects of certification (PSAC), software configuration index, and software accomplishment summary. We recommend that you submit the PSAC early in the software development process. Early submittal allows us to resolve issues in a timely manner, such as partitioning and determination of software levels.

6. MANUFACTURER DATA REQUIREMENTS. Besides the data given directly to us, have the following technical data available for review by the responsible ACO:

a. The functional qualification specifications for qualifying each production article to ensure compliance with this TSO.

b. Equipment calibration procedures.

c. Corrective maintenance procedures within 12 months after TSO authorization.

d. Schematic drawings of the components.

e. Wiring diagrams of the components.

f. Material and process specifications.

g. The results of the environmental qualification tests conducted per RTCA/DO-160E.

h. If the article includes computer software, the appropriate documentation defined in RTCA/DO-178B, including all data supporting the applicable objectives in Annex A, Table A-1, Process Objectives and Outputs by Software Level.

7. FURNISHED DATA REQUIREMENTS. If giving one or more articles to one entity (such as an operator or repair station), provide the following for each article manufactured under this TSO:

a. One copy of the technical data in paragraphs **5.a** through **5.h** and **5.k** of this TSO. Add any other data needed for the proper installation, certification, and use, or for continued airworthiness, or both, of the CIR system.

b. One copy of the data in paragraphs **5.l** through **5.n**, if the article performs functions beyond those described in paragraphs **3** and **3.a** of this TSO.

8. HOW TO GET REFERENCED DOCUMENTS.

a. Order EUROCAE documents from EUROCAE, 17 rue Hamelin, 75116 Paris France. Telephone 33 (0) 1 4505 7188, fax 33 (0) 1 4505 7230. You can also order copies from the EUROCAE Internet website at www.eurocae.org.

b. Order RTCA documents from RTCA, Inc., 1828 L Street, N.W., Suite 805, Washington, DC 20036-4001. Telephone (202) 833-9339, fax (202) 833-9434. You can also order copies from the RTCA Internet website at www.rtca.org.

c. Order copies of 14 CFR part 21, Subpart O, from the Superintendent of Documents, Government Printing Office, P.O. Box 37154, Pittsburgh PA 15250-7954. Telephone (202) 512-1800, fax (202) 512-2250. You can also order copies at www.access.gpo.gov. Select "Access," then "Online Bookstore." Select "Aviation," then scroll to "Code of Federal Regulations."

d. You can find a current list of technical standard orders on the FAA Internet website Regulatory and Guidance Library at www.airweb.faa.gov/rgl. You will also find the TSO Index of Articles at the same site.

Susan J. M. Cabler
Acting Manager, Aircraft Engineering Division
Aircraft Certification Service